

#### (Remote) Access to the Control System

kasemirk@ornl.gov, August 2019

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#### FY19 to date - Major sources of downtime by group/subsystem

-			Downtime	% of overall	
Group	Subgroup	Event	(hrs)	downtime	# Events
Controls	Cryogenics	CM5-8 pressure sensor PS failure; trip	8.1	0.46	3
Controls	Scrapers/foil	Ring scraper & foil control failure	15	0.86	2
Controls	Timing	Timing system source offline; encoder failure	9.4	0.54	5
Controls	MPS	Card, optocoupler, cable failures; latched faults	5.9	0.34	9
Controls	Vacuum	FE PLC fault tripped FE vacuum CCL Digibox failure	6.6	0.38	2
Cooling	QMCS	CCL2 FT505 failure	4.7	0.27	1
Cryogenics System	VFD	2K cold box trip; C4 blown fuse & failed capacitor	22.7	1.30	1
CM/SRF	CM02	Chatter faults, vacuum activitiy	3.5	0.20	36
CM/SRF	CM06	Chatter faults, vacuum activitiy	2.8	0.16	6
E-other	AC Power Distribution	RN-4DP5 trips, replacement; RN-02B breaker failure	5.9	0.34	4
E-HVCM	CCL4	Modulator failure, tank swap; high current fault	25.9	1.48	3
E-HVCM	RFQ	High dissolved gas; HV cable failure, IGBT gate driver	12.6	0.72	10
E-HVCM	SCL21	Failure in tank; faults	5.7	0.33	4
E-HVCM	DTL3	IGBT failure	3.1	0.18	1
E-MagPS	Linac MagPS	CCL1 Q104t111 ground faults; DTL DCH155 faults	11.7	0.67	9
E-MagPS	Ring MagPS	DHA10 fuse failure; DH main faults; Ekicker faults	8.3	0.47	19
E-other	TVA 161 KV Power	Power dips	13.1	0.75	13
Ion Source	HV	65kV trips & failure; voltage dips	7.5	0.43	15
Ion Source	RF	13MHz trips, failure; plasma outages	23.9	1.37	11
Ion Source	LEBT Electrodes	LEBT high temp; faults, e-dump issues	3.6	0.21	5
Protection Systems	PPS	Linac IO comm failure; Linac A door fault	4.9	0.28	2
RF Systems	CCL2 HPRF	Cathode overcurrent faults; filament PS fan failure	24.1	1.38	32
RF Systems	DTL HPRF	DTL5 window conditioning & trips; various faults	37.4	2.14	37
RF Systems	SCL HPRF	SCL 20 MagPS failure; vacion PS controller failure, various faults	4.3	0.25	8
RF Systems	SCL LLRF	CM03b DC bias PS fault; 04b MPS status fault; arc test failures	5.8	0.33	21
Target - CMS	CMS	Cooldown; troubleshooting	12.3	0.70	4
Vacuum Systems	СС	TMP 204a controller issues; window vacuum faults	3.5	0.20	7
Vacuum Systems	RFQ	RFQ conditioning from TMP failure	14.2	0.81	4
		Totals:	306.5	17.53	274
		Total FY19 to date downtime:	1748.2		

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Glen Johns, 8/7/2019



.. see what's going on right now?

.. look at some detail for my subsystem?

.. review the history of some temperature, current, voltage?

.. help operators react to issues with my subsystem?

#### How does the Control System work?





#### Technology over Time









New Gadget every 2 years. Plethora of Apps. Weekly update.



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Control System: Conceptually similar Issues

Several components

• Status Web Site, Logbook, EDM, CS-Studio, Alarms

Changing over time

• Some old, some new



### Control System: Necessarily Protected



# High Level View: <u>http://status.sns.ornl.gov</u>



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Aug 21 00:00

26.0 25.5 25.0

Aug 19 00:00

Aug 20 00:00

(not Internet Explorer)

# Logbook - 'E Log'

• Browse recent entries on <u>http://status.sns.ornl.gov</u>

💐 Logboo	l <b>k</b> ≡ Mer	u
Operations	Timing Master Maitenance - Completed - T Justice	
2019-08-08 10:08	Timing Master work has been completed. Timing has been restored and returned to operations.	
	This work included removing hardware from the rack that is not longer in use and doing power measurements on the 10Mhz Master Oscillator reference signal.	
SNS	IHC Beamline 15 - NSE - Jeffrey Duff	
Instrument	Operations	
Hall		
Coordinators	IHC assisted RMs with performing the routine running of the spare chiller at BL-15. Chiller was operated for about 10 minutes and then was turned off and valves	
2019-08-08	placed back into normal positions when operating on just building SCW.	1019 10:07 T Justice Timing Master Maitenance - Completed {Operations} (Controls)
10.07		Posted: Thu, Aug 08, 2019 10:08 ter work has been completed. Timing has been restored and returned to

customize...

This work included removing hardware from the rack that is not longer in use and doing power

#### Entry Composer

Never saved

#### • Click on entry title for full SNS Logbook

- Login: 3-letter UCAMS
- Reply to entry

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- Create new entry

SPALLATION NEUTRON

SOURCE

	Version 7.2.0 (Enterprise Network)
2	a a la
	ogin
	User ID: username
	Password: password
	Logi
	amost a name account
e	<u>quest</u> a new account.

* Aug 08, 2019 10:07	None ( EN implie	≎ s email notification )	None 0	Send	Work Order		
*Logbooks		Categories Show Call List		Impact Areas Show Impact Areas			
Accelerator Physics Automated Entries Beam Instrumentation CUB-Mechanical Utilities Controls Cooling Systems Cryogenics System Cryomodule Facilities	0	Accelerator Physics Beam Instrumentation Beam Stops and Dum CUB-Mechanical Utilit Controls Cooling Systems - Acc Cryogenics Document Control Ce	ps ties celerator nter	ASOC (8350) Beam Test Facility (withi CHL (8310) CLO (8600) CLO (8600) ? Lab (C-24 CLO (8600) ? Lab (D-21 CLO (8600) ? Lab (D-21 CLO (8600) Beam Instru	n 8320) 1) 4) 4) mentation Lab (C-143)	1	
Categories: Controls * Title: Re: Timing Master Mait	enance - Comp	eted					
* Content: (4000 character In addition, we found that	limit)						
* Content: (4000 character In addition, we found that	limit)						
* Content: (4000 character In addition, we found that Characters remaining: 3968 * Required Field	limit)						

#### View "EDM" Control Room Displays

a) Go to the control room for full read/write access

b) Run read-only EDM on ics-srv02

c) Use Web EDM (since ca. Feb. 2019)



### EDM in the Control Room

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- Operators can help you find what you're looking for
- You have write access, i.e. control of your equipment



# EDM on ics-srv02

EDM

- Runs on Linux computers (not Windows, not Mac)
- Needs access to the display files and the PV data
- $\rightarrow$  Run it on srv02, a Linux computer for remote access
- 1. Install
  - a) Mac: XQuartz
  - b) Windows: PuTTY and Xming
  - c) Linux: Nothing
- 2. From home: VPN into ORNL network
- 3. ssh-YC ab1@ics-srv02.ornl.gov
- 4. startmap-remote



#### EDM on ics-srv02 Details

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- Need UCAMS "Workstation Password Server" role
  - Contact Greg Lawson regarding login problems
- Windows PuTTY & Xming details: ORNL IT support, Katie Palmer

😫 PuTTY Configu	iration	$\times$				
Category:						
	Basic options for your PuTTY session					
Logging	Specify the destination you want to connect to Host Name (or IP address) Port		Representation ×		~	
···· Keyboard ···· Bell	7tp@ics-srv02.oml.gov	22	Keyboard A	Options controlling SSH X11 forwarding		
Features ⊡Window	Connection type: ○ Raw ○ Telnet ○ Rlogin ● SS	SH 🔿 Serial	- Bell - X11 forv Features	varding	₽ 7tp@ics-srv02:~	– 🗆 ×
Appearance Behaviour	Load, save or delete a stored session		Window X display	y location	Last login: Wed Sep 21 16:55:09 2016 from pc102416.ornl.gov	
···· Translation ···· Selection	epics			X11 authentication protocol -Magic-Cookie-1 OXDM-Authorization-1	NOTICE TO USERS	
Colours Connection Data Proxy Telnet	Default Settings dmz dmz2 epics	Load Save Delete	Selection X author Colours	X authority file for local display Browse	This is a Federal computer system and is the property of the Government. It is for authorized use only. Users (authorized unauthorized) have no explicit or implicit expectation of pri Any or all uses of this system and all files on this system m	United States d or vacy. mav be
	Close window on exit: Always Never Only on	clean exit	···· Proxy ···· Telnet ···· Rlogin ⊡· SSH ···· Kex ···· Cipher		intercepted, monitored, recorded, copied, audited, inspected, to authorized site, Department of Energy, and law enforcement well as authorized officials of other agencies, both domestic By using this system, the user consents to such interception, recording, copying, auditing, inspection, and disclosure at t of authorized site or Department of Energy personnel.	and disclosed personnel, as and foreign. monitoring, the discretion
About	Open HIGH FLUX SPALLATION SOTOPE NEUTRON	Cancel	Auth     TTY     Tunnels     Bugs		Unauthorized or improper use of this system may result in adm disciplinary action and civil and criminal penalties. By con this system you indicate your awareness of and consent to the conditions of use. LOG OFF IMMEDIATELY if you do not agree t conditions stated in this warning.	inistrative tinuing to use se terms and o the
National Laboratory	REACTOR   SOURCE		About	Open Cancel	[7tp@ics-srv02 ~]\$ startmap-remote	

# Web EDM (JLab)



#### Archived Data

Historic data for many of the PVs, stored in Oracle database, accessible on Office network or VPN

- CS-Studio
  - Data Browser for archived data
  - Display tool similar to EDM, used on beamlines
  - Alarm toolkit, used in control rooms
- Download link on Status Web site 'Other' page
  - <u>https://controlssoftware.sns.ornl.gov</u>
  - "Phoebus", for SNS





### CS-Studio Data Browser

- Applications, Display, Data Browser
- Right-click into plot, "Add PV", enter PV Name
- Maybe add more PVs
- Configure time range
  - Time range button in toolbar

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 Ctrl + Mousewheel while mouse over time axis



#### CS-Studio Data Browser

- How to get PV name?
  - a) In (Web) EDM, Middle-click on item to see & copy PV nameb) Right-click in Data Browser to Open Archive Search Panel
- Even w/o archived data, Data Browser shows 'live' data
- File, Save \*.plt file to later re-use a plot configuration
- Print; email; send to logbook; export to spreadsheet

More in Help, Applications, Data Browser



# Alarms: EPICS PV States

- OK
- MINOR
  - Small issue, 'warning'
  - Usually shown w/ yellow border
- MAJOR
  - Trouble, 'alarm'
  - Usually shown w/ red border
- INVALID

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Well, we don't know

- a) No operator ever entered a value, otherwise OK
- b) Maintenance day, somebody has unplugged a cable, no worries.
- c) We cannot read from the PLC, the building may be on fire!?
- Usually shown white, or with purple border



# Alarms: PV Configuration

What's the threshold for a temperature PV to become MINOR or MAJOR?

Is "valve open" OK, MINOR, MAJOR, ..?

- 1. Subsystem expert needs to decide:
  - a) Is any value OK?
  - b) Is there one fixed alarm threshold, or do we need to change it all the time?
  - c) Should the threshold automatically adjust, or is it manually entered?
- 2. IOC engineer needs to implement alarm behavior of PV

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#### If a PV alarms in the forest and nobody sees it ...

- a) That may be totally fine. The display is for the subsystem expert to look at, once a week. He/she'll decide what to do.
- b) That means value #17 needs to be opened ASAP. IOC engineer can automate this on the IOC.
- c) It's a problem, without recipe that could be automated.
   Somebody needs to look at it intelligently very soon.
   → Add to alarm handler!

# Add Alarm to Alarm Handler

Meet:

- Subsystem expert
- IOC engineer
- Operator

Define:

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- What is the purpose of this alarm?
- What should operators <u>do</u> in response to the alarm?
- Is there already a good trigger PV?
- What related displays to open?

→ Operations resp. IHC contacts

https://ics-web.sns.ornl.gov/wiki/AlarmHandling/Philosophy



## Summary

- Overall: <u>http://status.sns.ornl.gov</u>
- Communication: Logbook
- Control System Details: EDM
  - Most convenient via <a href="https://controlssoftware.sns.ornl.gov/wedm">https://controlssoftware.sns.ornl.gov/wedm</a>
- Archived Data: CS-Studio
  - Download from <a href="https://controlssoftware.sns.ornl.gov">https://controlssoftware.sns.ornl.gov</a>
- Alarms
  - Can help operators react early and with purpose

